(*c.*) The solution of the problem in both the cases of long shafts and short axles depends upon the discovery of a series of discontinuous functions. These functions would appear to have considerable interest for the mathematician. Like functions first appear, I think, in a paper by Boussinesq,* and they offer an alternative to the usual solution of problems in vibration by Fourier's series. The latter in such cases often give easy analytical expressions, which, however, may be almost useless for the purposes of numerical calculation owing to the slowness of their convergence. In the course of the paper the numerical solution by the use of discontinuous functions, is compared for one case with the solution obtained by a Fourier's series. A verification of the work is thus obtained, and the advantages of the novel functions illustrated.

(*d.*) There are many points in the memoir which suggest possibilities for physical research, and it seems to me that both from the purely scientific and the engineering sides a well-devised series of experiments on continuously and on abruptly varying torsional loads would lead to results of much interest and practical value.

The memoir endeavours to complete as fully for torsional loading the theory of a changing load as the latter has been completed for longitudinal and transverse loading by de Saint-Venant, Boussinesq, and Flammant. The methods, analytical and graphical, are analogous, but the whole of the results, algebraic and numerical, are, I believe, novel, and apply to a series of cases which, if possible, have even greater practical importance.

"The Nature and Origin of the Poison of *Lotus Arabicus*. Preliminary Notice." By WYNDHAM R. DUNSTAN, M.A., F.R.S., Sec.C.S., Director of the Scientific Department of the Imperial Institute, and T. A. HENRY, B.Sc. Lond., Salters' Company's Research Fellow. Received June 7—Read June 14, 1900.

Lotus Arabicus is a small leguminous plant resembling a vetch, with pink flowers, indigenous to Egypt and Northern Africa. It grows abundantly in Nubia and is especially noticeable in the bed of the Nile from Luxor to Wady Halfa. It is known to the natives as "Khuther," and old plants with ripe seed are used as fodder. The dried plant is unusually green, and possesses the aroma of new-mown hay. At

* See 'History of Elasticity' vol. 2, arts. 401, 402.

certain stages of its growth it is highly poisonous to horses, sheep, and goats, the poisonous property being most marked in the young plant up to the period of seeding. Owing to the trouble which this plant has given to the military and civil authorities in Egypt, the assistance of the Director of Kew was sought in order that the precise nature of the poison might be ascertained, and, if possible, a remedy found. The matter having been referred to the Scientific Department of the Imperial Institute, Mr. E. A. Floyer, Director of Egyptian Telegraphs, collected some of the material for investigation.

It was found that when moistened with water and crushed, the leaves of the plant evolved prussic acid in considerable quantity, the amount being greatest in the plant just before and least just after the flowering period. Further investigation has shown that the prussic acid originates with a yellow crystalline glucoside ($C_{22}H_{19}NO_{10}$), which it is proposed to name *lotusin*. Under the influence of an enzyme, also contained in the plant, lotusin is rapidly hydrolysed, forming *prussic acid*, *sugar*, and *lotoflavin*, a new yellow colouring matter.

The hydrolysis may be effected by dilute acids, but is only very slowly brought about by emulsin and not at all by diastase. The peculiar enzyme, which it is proposed to call *lotase*, appears to be distinct from the enzymes already known. Its activity is rapidly abolished by contact with alcohol, and it has only a feeble action on amygdalin. Old plants are found to contain lotase but no lotusin.

The *sugar* has been proved to be identical with ordinary dextrose.

Lotoflavin, the yellow colouring matter, has the composition expressed by the formula $C_{15}H_{10}O_6$. It belongs to the class of phenylated pheno-γ-pyrones, and is a dihydroxychrysin, isomeric with luteolin, the yellow colouring matter of *Reseda luteola*, and with fisetin, the yellow colouring matter of *Rhus cotinus*.

The decomposition which ensues on bringing lotase in contact with lotusin, as happens when the plant is crushed with water, is therefore probably expressed by the following equation:—

$$\underset{\text{Lotusin.}}{C_{22}H_{19}NO_{10}} + 2H_2O = \underset{\text{Lotoflavin.}}{C_{15}H_{10}O_6} + \underset{\text{Prussic acid.}}{HCN} + \underset{\text{Dextrose.}}{C_6H_{12}O_6}.$$

Hydrocyanic (prussic) acid occurs in small quantity in many plants, and according to Treub and Greshof is often present in the free state. The only glucoside at present definitely known which furnishes this acid is the well-known amygdalin of bitter almonds, which under the influence of the enzyme emulsin, also contained in the almond, breaks up into dextrose, benzaldehyde, and prussic acid.

Owing to the scientific interest which attaches to this new glucoside, its properties and those of its decomposition products have been very fully studied, and the characteristics of the new enzyme have also been investigated.

We are much indebted to Mr. Floyer for the great pains he has taken to collect, in Nubia, the necessary material for this investigation, and also to Sir W. T. Thiselton-Dyer for having grown the plant at Kew, from seed obtained from Egypt.

"On the Spectroscopic Examination of Colour produced by Simultaneous Contrast." By GEORGE J. BURCH, M.A., Reading College, Reading. Communicated by FRANCIS GOTCH, F.R.S., Professor of Physiology, University of Oxford. Received June 12,—Read June 21, 1900.

In a previous communication I have described some methods of using the spectroscope to analyse sensations of successive contrast. In those experiments the eye, after having been fatigued by monochromatic—preferably spectral—light, is exposed to a second stimulus, consisting also of spectral light, exciting one or more colour-sensations which may or may not include that fatigued by the primary sensation. The question naturally arises, whether the spectroscopic method might not be applied to problems of simultaneous contrast.

With this view I made a number of experiments with the Marlborough spectroscope during the summer of 1897, of which the following may be mentioned. A piece of thin cover-glass was fixed in front of the eye-piece at an angle of 45° with the optic axis, so as to reflect into the field of view a small complete spectrum furnished by a $3\frac{1}{2}$-inch direct-vision spectroscope. In order that this might be visible against the bright field of the larger spectroscope, a glass disc, with an opaque spot of the required size painted on it, was inserted in the eye-piece close to the diaphragm.

With this arrangement it was easy to see the effect of contrast upon the smaller spectrum, but the lack of a comparison spectrum made the experiment far less striking than I had anticipated.

Recently a device has occurred to me by which this difficulty may be got over, namely, the production of simultaneous contrast by different colours in the two eyes.

This method is employed in the well-known experiment by Hering, to show that the apparent alteration of colours by contrast is not due to an error of judgment, but to some real effect produced in the eye itself.

An ordinary stereoscope is very convenient for this purpose, a square of red glass being inserted on one side of the central partition and a square of blue glass on the other. A small black wafer is then fixed at the centre of each glass, with a white wafer close to the left side of the one on the right-hand glass, and another on the right side of that